Goals of SMTF Collaboration

& discussions with DESY

(many of these transparinces taken from the 2 Argonne SRF meetings in Feb and May)

hedwards

Sept 30, 04

Jlab-SMTF

Goals of the SMTF Collaboration

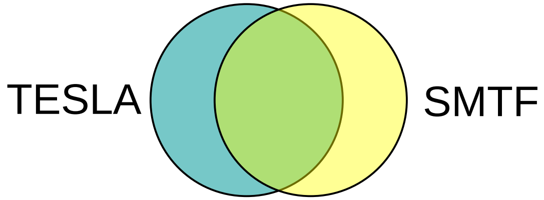
The SMTF collaboration has & should have goals beyond a cryomodule or a module test facility.

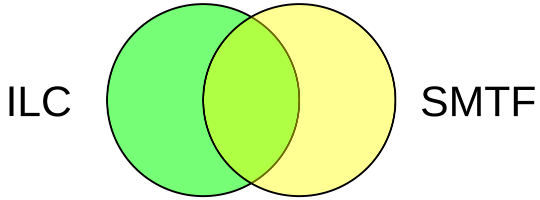
- It should be a broad collaboration to grow and develop SRF technology over diverse end use applications foreseen in US.
  - ❖ To this end, effort should be made to support diversity.

- It is a great opportunity to show extensive, coordinated, and integrated participation by a broad mix of US labs, universities and industry for the technology and its development.

  It is a great opportunity AND It is a great challenge.

- It builds upon the efforts of the TESLA collaboration, relies heavily on integrated participation with them, and should have major overlap with them.





SMTF should :

- Be the foundation for formation of a US broad collaboration on development of srf technology for future projects. The success of forming such a broad collaboration will be important to its support and over all funding support to the potential projects.

- Be a partner with TESLA Collaboration - Avail itself of TESLA experience and build upon and supplement it.

- Be open and incorporate international participation to the greatest extent possible.

- Be a foundation for development and participation of US industry.

- Collect srf information or data bases and form loose working groups on different technical questions so that the community as a whole benefits.

- Does not produce a situation where over centralization inhibits creativity and the ability to carry out interesting initiatives at partner labs.

The strength of collaboration

Unites us all into common attack on technology issues
Brings the best expertise to each task, and constructive competition
Reduces redundant effort and cost as much as possible
Makes it possible to cover more of the questions to be answered
because a greater variety of people

I have been impressed with the success of TTF and the broad participation
that have led not only to great progress in SRF but also beam physics
and instrumentation development

Collaboration is clearly essential for large future projects
If we can do it here, it may generate the unified support for SRF in this
country that so far has been hard to obtain.

We also need to develop strong collaboration with US industry and strengthen
their capabilities.

From Argonne Meeting in Feb

Comments WG 3 RF Infrastructure-

While a large community of people have been involved in developing high performance superconducting (SC) cavities for a long time and have been very successful at it, there is a lot of other infrastructure that needs to be developed when it comes to a project. Much of this infrastructure turns out to be a cost driver in many cases and if not developed properly in time will be schedule driver or both.
The SRF facility idea could be an ideal melting pot for the scattered effort around the labs to provide a database to collect data, drawings, experience and a testing ground for this infrastructure. ....

SRF Module Test Facility
R&D
Gaps in Knowledge & Capabilities

Research on modules

- The whole CW operations area
    - Hi Q operation at reasonable gradients
    - Hi Ext Q operation (minimize RF power)
    - HOM power, Hi/Low beam current

Development on modules (pulsed)

- Life and systems development and testing
- New cavity and module designs testing
- RF & llrf control development

Beam capability (at least for some of the systems)

- Beam is an essential part of a real systems test (eg llrf)
- Having beam allows for R&D in Acc Beam Concepts

Conclusions From Feb meeting

Gaps in knowledge

The gaps in existing capabilities that we seek to fill in Phase I are:-

- Demonstrate 20 MV/m CW operation at Q values of >3-5x 10^10.

- Operate at 20 MV/m at a Qext > 10^7 for low beam loading applications.

- Demonstrate >35 MV/m at 1% duty factor with high beam loading. For the above a high frequency (1200 - 1600 MHZ) is desirable. The existence of RF power sources may bias the choice to 1300 MHz.

- Demonstrate >15 - 20 MV/m high duty factor operation in a medium beta(near 0.5) elliptical structure,at a Q > 5x10^9. A single klystron should feed multiple cavities in the module and appropriate RF control issues for such a distribution should be addressed.

What we are NOT trying to do in this Facility

Many places have facilities for cavity processing and vertical dewar testing or small module testing. Industry and labs can both fabricate cavities.

We are not trying to do fundamental SRF materials and surface science here. But when basic improvements get to the point of being able to test cavities in test modules, then those improvements get integrated into the facility.

Development - In this context what is development? what needs development?

The TTF experience

- The modules are sometimes built over 2 years before they can be tested.
- When they are tested, there is never enough time to do many of the critical tests that should be done in a development program.

Some examples-

- What is the maximum operating gradient of each cavity in a module? and its limiting feature (quench, low Q, dark current, etc)
- What is the dark current of each cavity in each direction?
- What is typical dark current of "good" cavities at Hi Grad?
- How long does it take to process input couplers?
- What is the trip rate from cavities and couplers? How long does it take to recover from trips?

More Questions- Cold LC

Systems Life testing
cavity and coupler performance
cavity HOM detuning cavity to cavity
dark current and heat load
dark current wakes?
llrf control and exception handling (and piezo's)
beam energy variation - rf control
loss of cavity vacuum and recovery
klystron/modulator performance
quad and cavity vibration- beam jitter, vib driven by pulsing
quad and cavity alignment and alignment stability- thermal cycles
cavity centerline and tilt- (for wakes)
BPM stability to quad
quad centers, and motion of centers as turn off quads for "ballistic tuning"
magnetic fields from linac acting on damping ring
HOM absorber (>7GHz)

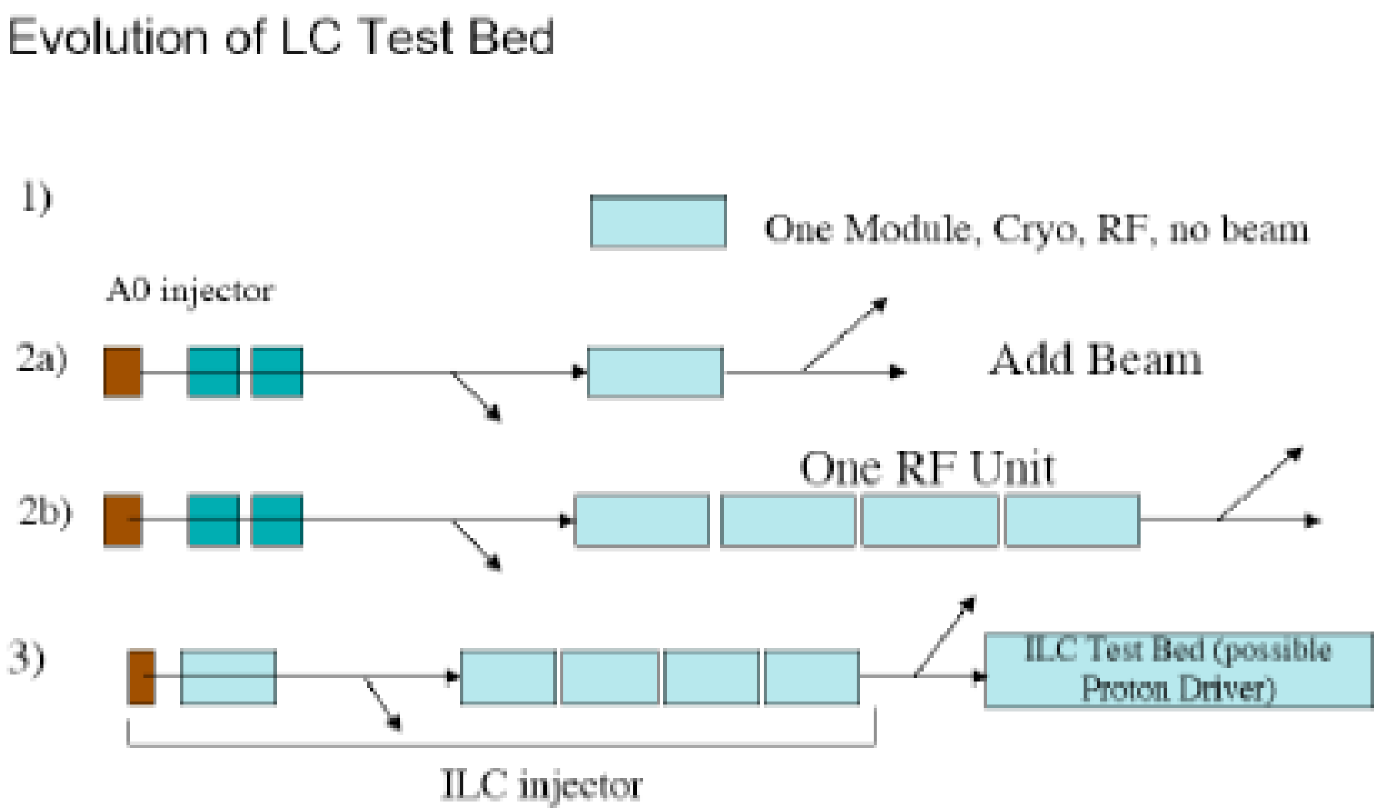
The R1 & R2 Module & “RF Subunit” Goals

R1 -Build 35MV/m cryomodule, measure quench/breakdown rate
and dark current- commensurate with expectations and manageable.
R2 -Test complete RF sub unit with several modules at nominal field
couplers, controls(llrf), alignment, quench, breakdown rates

- cryo module & quad information on sources/and levels of vibration
- development of most critical instrumentation
- evaluation of critical sub system reliability (MTBF, MTTR, MTBO)

- To finalize the design choices and evaluate reliability issues it is important to fully test the basic building block of the linac. For TESLA, this means several cryomodules installed in their future machine environment, with all auxiliaries running, like pumps, controls etc. The test should as much as possible simulate realistic machine operating conditions, with the proposed klystron, power distribution system and with beam. The cavities must be equipped with their final HOM couplers, and their relative alignment must be shown to be within requirements. The cryomodules must be run at or above their nominal field for long enough periods to realistically evaluate their quench and breakdown rates. This Ranking 2 R&D requirement also applies to the upgrade. Here, the objectives and time scale are obviously much more difficult.

SMTF-ILC Evolution



TESLA Module Status

As of Collaboration meeting sept 04

Module Summary

- Module 6 35MV (type III) optimistic June 05

  needs piezos, no BPM

- Module 7 spare (type II) (35MV not required but want to use new cavities and EP to gain statistics)

  needs Type II helium vessels

  Dec 05, Jan06

- Module test stand commissioning Nov 05

  Want to test module 6 in test stand before installation in TTF

- Module 8 and beyond need many components like cold mass

Need to immediately take action on piezos and Helium vessels

Cryomodule parts (cont.)

modules beyond 6 &7

modules	cavities	Cold mass + v-vessel	tuners	magnets	He-vessels	BPM	Main Couplers
Total Availabl e now	30	1 type II 1 type III	17	2 TTF 1 TESLA	20 type III		40
6			piezos			?	
7	Old?	Sstruct	piezos		8 II	?	
8				XFEL Type ?	4		
9	2			XFEL-type ?	8		

Discuss soon with TESLA (DESY, INFN, ORSAY)

We need to meet with the TESLA people to discuss:

• if we can help on the 35MV module

• just what a “DESY module” and the “1st US module” will contain. (They should be the same)

• and what the possible order of module building past 7 will be.

END

STOP

Conclusions Phases (2)

Phase I-
to develop, build and test with beam two distinct types of cryo
the tests would be long term tests- these modules and tests sh
existing gaps in SRF capabilities that are needed for upcoming
participating labs will benefit from these demonstrations when
funding for their projects.

Phase II-
Interested labs can bring their modules and RF equipment to t
facility established in Phase I, provided there is sufficient com
with the infrastructure, cryo and available beam-

The facility can serve as an initial test bed in US for the LC if t
technology is chosen.

More about the SMTF model?

- Somewhere we want a basic infrastructure
  and a basic module setup
- Individual Labs collaborate on the building of this basic setup
  and operation (different labs take on different responsibilities)
- Individual labs also prepare speciality equipment & tests of their
  specific interest

Can we come up with a "basic setup" ? (freq, pulse length, ...)
Do speciality interests integrate into this picture?

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